

CLAIMS

1. An image display apparatus comprising:

(a) a luminous device composed of two-dimensionally arrayed plural semiconductor lasers;

5 (b) a parallel-conversion optical system for directly inputting beams output from the luminous device and converting the beams into substantially parallel beams;

(c) an optical switch for inputting beams output from the parallel-conversion optical system and modulating the beams; and

10 (d) a display optical system for inputting beams modulated by the optical switch in order to display an image.

2. The image display apparatus of claim 1, further comprising a beam-conversion optical system between the parallel-conversion optical system and the optical switch, for converting a section size of the beams into a light-utilization size for the optical switch.

15 3. An image display apparatus comprising:

(a) a luminous device composed of two-dimensionally arrayed plural semiconductor lasers;

20 (b) a beam-conversion optical system for directly inputting beams output from the luminous device and converting at least one of a beam section shape and a beam section size of the beams;

(c) an optical switch for inputting beams output from the beam-conversion optical system and modulating the beams; and

(d) a display optical system for inputting beams modulated by the optical switch in order to display an image.

25 4. The image display apparatus of claim 3, further comprising a parallel-

conversion optical system between the beam-conversion optical system and the optical switch, for inputting the beams output from the beam-conversion optical system and converting the beams into substantially parallel beams.

Sub B2 5. The image display apparatus of claim 1 ~~or 3~~, wherein each of the two-

5 dimensionally arrayed plural semiconductor lasers is one of a semiconductor laser outputting a multi-mode laser beam and a semiconductor laser outputting a laser beam of wide spectrum.

a 6. The image display apparatus of claim 1 ~~or 3~~, wherein the luminous device includes arrayed integrated semiconductor lasers.

a 7. The image display apparatus of claim 1 ~~or 3~~, wherein the luminous device includes a surface-emitting semiconductor laser.

8. An image display apparatus comprising:

(a) a luminous device composed of arrayed plural discharge lamps;

(b) an optical switch for inputting beams output from the luminous device and modulating the beams;

(c) a parallel-conversion optical system for inputting one of the beams output from the luminous device and beams modulated by the optical switch, and converting input beams into substantially parallel beams; and

(d) a display optical system for inputting one of beams output from the parallel-conversion optical system and the beams modulated by the optical switch in order to display an image.

9. An image display apparatus comprising:

(a) a luminous device composed of arrayed plural electro-luminescent elements;

(b) an optical switch for inputting beams output from the luminous device and

modulating the beams;

(c) a parallel-conversion optical system for inputting one of the beams output from the luminous device and beams modulated by the optical switch, and converting input beams into substantially parallel beams; and

(d) a display optical system for inputting one of beams output from the parallel-conversion optical system and the beams modulated by the optical switch in order to display an image.

10. The image display apparatus of claim 1, ~~3, or 9~~, wherein the optical switch is a liquid crystal panel.

11. The image display apparatus of claim 1, ~~3, or 9~~, wherein the optical switch is a reflection type liquid crystal panel.

12. The image display apparatus of claim 1, ~~3, or 9~~, wherein the luminous device has plural light sources, an array shape of which is similar to a light-utilizing shape of the optical switch.

13. The image display apparatus of claim 8, further comprising a controller for controlling each of the plural light sources.

14. The image display apparatus of claim 8, wherein the luminous device is an aggregation of light sources having different spectral distributions.

15. The image display apparatus of claim 8, wherein the luminous device is an aggregation of discharge lamps, a gap length of each of which is less than 4mm,

outputting parallel beam luminous flux of lumen equal to and more than several hundred, and the parallel-conversion optical system is an aggregation of reflectors making beams output from each of the discharge lamps be parallel beams.

16. The image display apparatus of claim 8, wherein the luminous device is able to change at least one of a beam section shape and a beam section size.

17. The image display apparatus of claim 8, wherein the luminous device is able to

change a light source type.

18. The image display apparatus of claim 8, wherein the luminous device is able to change an array shape of light source.

19. The image display apparatus of claim 8, wherein the luminous device allocates
5 light sources having different sizes.

20. The image display apparatus of claim 8, wherein the luminous device includes a lamp in which a part of a discharge tube is used as a reflector.

21 An image display apparatus comprising:

(a) a light source for emitting beams based on superradiation;

Sub 10 (b) an optical switch for inputting substantially linearly polarized beams output from the light source and modulating the substantially linearly polarized beams; and

(c) a display optical system for displaying beams modulated by the optical switch.

15 22. The image display apparatus of claim 21, wherein the image display apparatus is a projection type image display apparatus and the light source is used for the projection type image display apparatus.

23. The image display apparatus of claim 22, further comprising:

(a) a light source for color image;

(b) a light source for luminance image;

20 (c) an optical switch for color image for creating a color image by using the light source for color image;

(d) an optical switch for luminance image for creating a luminance image by using the light source for luminance image; and

25 (e) a combining optical system for combining the color image created by the optical switch for color image with the luminance image created by the optical switch for

luminance image in order to create a combination image;

wherein the light source for emitting beams based on superradiation is used for at least one of the light source for color image and the light source for luminance image.

5 24. The luminous element of claim 21, wherein the light source is used for a direct-view type image display apparatus.

25. The luminous element of claim 21, wherein the light source includes an electro-luminescent element.

26. The luminous element of claim 21, wherein the light source includes a light emitting diode element.

27. An image display apparatus comprising:

(a) a light source for emitting beams based on superradiation; and

(b) a display optical system for displaying beams modulated and output at the light source.

15 28. The image display apparatus of claim 27, wherein the image display apparatus is a projection type image display apparatus and the light source is used for the projection type image display apparatus.

29. The image display apparatus of claim 28, further comprising:

(a) a light source for color image;

20 (b) a light source for luminance image;

(c) an optical switch for color image for creating a color image by using the light source for color image;

(d) an optical switch for luminance image for creating a luminance image by using the light source for luminance image; and

25 (e) a combining optical system for combining the color image created by the optical

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switch for color image with the luminance image created by the optical switch for
luminance image in order to create a combination image;
wherein the light source for emitting beams based on superradiation is used for at
least one of the light source for color image and the light source for luminance
5 image.

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30. The luminous element of claim 27, wherein the light source is used for a
direct-view type image display apparatus.

31. The luminous element of claim 27, wherein the light source includes an
electro-luminescent element.

10 32. The luminous element of claim 27, wherein the light source includes a light
emitting diode element.

33. An image display apparatus comprising:

(a) a light source for color image;

(b) a light source for luminance image;

15 (c) an optical switch for color image for creating a color image by using the light
source for color image;

(d) an optical switch for luminance image for creating a luminance image by using
the light source for luminance image; and

(e) a combining optical system for combining the color image created by the optical
20 switch for color image with the luminance image created by the optical switch for
luminance image in order to create a combination image.

34. An image display apparatus comprising:

(a) a luminous device composed of arrayed light sources outputting different
wavelength beams in time-sharing.

25 35. An image display apparatus comprising:

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(a) a luminous device composed of arrayed light sources outputting different wavelength beams in time-sharing, and

(b) an optical switch for inputting the different wavelength beams output from each of the arrayed light sources of the luminous device, and modulating input
5 different wavelength beams in time-sharing.

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36. The image display apparatus of claim 34 or 35, wherein the luminous device is composed of a plurality of luminous devices in which a plurality of semiconductor lasers outputting same wavelength beams is arrayed, and each of the plurality of luminous devices operates in time-sharing in order to output a beam in time-sharing.
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37. The image display apparatus of claim 34 or 35, wherein the luminous device is composed of arrayed semiconductor laser groups, each of which is made of semiconductor lasers of plural kinds outputting different wavelength beams.

38. The image display apparatus of claim 37, wherein each of the semiconductor lasers of plural kinds operates in time-sharing in order to output a beam in time-sharing.
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39. The image display apparatus of claim 37, wherein the optical switch is a liquid crystal panel, and each of the arrayed semiconductor laser groups is provided to be corresponding to each pixel of the liquid crystal panel.

20 40. The image display apparatus of claim 37, wherein the luminous device includes a surface-emitting semiconductor laser composed of arrayed semiconductor laser groups, each of which is made of semiconductor lasers of plural kinds outputting different wavelength beams.

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25 41. The image display apparatus of claim 1, 34 or 35, further comprising a beam-conversion optical system for making a luminance distribution of beams output

~~from the luminous device to be uniform.~~

42. The image display apparatus of claim 41, wherein the beam-conversion optical system includes an analog phase control element for controlling a beam phase.

43. The image display apparatus of claim 42, wherein the analog phase control element is a modified curve surface lens.

44. The image display apparatus of claim 1, wherein the parallel-conversion optical system includes a lens array composed of arrayed plural lenses corresponding to the arrayed plural light sources of the luminous device.

45. The image display apparatus of claim 44, wherein each of the light sources is located at a position within a focal point of each of the arrayed plural lenses in order to make each of the arrayed plural lenses output beams diverging compared with parallel beams, so that circumference of each of the beams output from the each of the arrayed plural lenses can be overlapped each other.

46. The image display apparatus of claim 45, wherein the parallel-conversion optical system includes a single lens for inputting the diverging beams, whose circumference is overlapped, output from the each of the arrayed plural lenses, and outputting parallel beams.

47. The image display apparatus of claim 44, wherein at least either of the arrayed plural light sources and the arrayed plural lenses are installed to be movable in order to change a distance between the arrayed plural light sources and the arrayed plural lenses, so that a beam luminance distribution can be changed.

48. The image display apparatus of claim 1, wherein the luminous device is an integrated luminous device composed of integrated plural light sources, and the parallel-conversion optical system includes a lens located in order to make a center part of the integrated luminous device be a focal point of the lens.

49. The image display apparatus of claim 1, wherein the parallel-conversion optical system includes a transmission type diffraction grating.

sub 5 50. A luminous element comprising a linear polarization element for substantially linearly polarizing an emission light.

5 51. A luminous element comprising a concave reflecting mirror.

sub 55 52. The luminous element of claim 50 or 51, wherein the luminous element is arranged to be an array and used as a luminous device of an image display apparatus.

10 53. The luminous element of claim 52, wherein the luminous element is used as a luminous device of a projection type image display apparatus.

54. The luminous element of claim 52, wherein the luminous element is used as a luminous device of a direct-view type image display apparatus.

sub 56 55. The luminous element of claim 50 or 51, wherein the luminous element is an electro-luminescent element.

sub 57 56. The luminous element of claim 50 or 51, wherein the luminous element is a light emitting diode element.

sub 58 57. The image display apparatus of claim 1, wherein the luminous device is a field emission display, and the parallel-conversion optical system is unnecessary.

20 58. The image display apparatus of claim 57, wherein the field emission display also operates as the optical switch, by means of controlling a phosphor emission based on an electron beam on and off.

sub 59 59. The image display apparatus of claim 1, wherein the optical switch is a digital micro-mirror device composed of arrayed plural mirrors.

25 60. The image display apparatus of claim 1, wherein the luminous device is composed of plural light sources arrayed on a curved surface.

61. The image display apparatus of claim 60, wherein the curved surface has its curvature center on an optical axis of beams input into the optical switch.

62. The image display apparatus of claim 61, wherein the curved surface is a concave surface.

5 63. The image display apparatus of claim 61, wherein the curved surface is a convex surface.

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